

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11) EP 1 026 878 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication: 09.08.2000 Bulletin 2000/32

(51) Int. Ci.⁷: **H04N 1/405**, H04N 1/52

(21) Application number: 00300829.9

(22) Date of filing: 03.02.2000

(84) Designated Contracting States:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU

MC NL PT SE

Designated Extension States:

AL LT LV MK RO SI

(30) Priority: 05.02.1999 JP 2866699

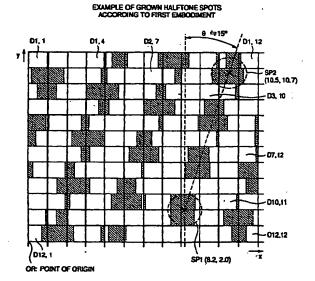
(71) Applicant: SEIKO EPSON CORPORATION Tokyo 160-0811 (JP) (72) Inventor:
Fujita, Toru,
c/o Seiko Epson Corporation
Suwa-shi, Nagano 392-8502 (JP)

(74) Representative:
Kenyon, Sarah Elizabeth et al
Miller Sturt Kenyon
9 John Street
London WC1N 2ES (GB)

(54) Color electrophotographic apparatus and method of processing an image produced thereby

(57) An image reproduction engine which causes toner to adhere to a development region of certain area located at a certain position within dots according to image reproduction data is utilized for image processing, wherein a halftone is expressed by means of halftone spots formed from a plurality of dots. The centroid of the halftone spot formed from a single dot or a plurality of adjacent dots is shifted from the center of the dot to an arbitrary position, thus achieving desired screen angles or desired pitches of halftone spots. As a result, screen angles related to an irrational tangent can be realized, and the pitches of halftone spots of a plurality of color screens can also be made uniform.

FIG. 4



1 026 87

·5 .

BACKGROUND OF THE INVENTION

for thanges has magne invagantation method. 1. Field of the Invention of the second research

[0001] The present invention relates to a color electrophotographic apparatus, which performs halftoning operations through use of halftone spots formed by a plurality of dots, a method of processing an image promote duced by the color photographic apparatus, and a recording medium having recorded thereon a program to be used for image processing in this specification, and electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses? Each as a unit cell in least electrophotographic apparatuses?

ு நாடாகளால் காகையும் வாழ்க்கு ஊரில் பி. base பற்றே உழு 2. Description of-the Related:Art அதல் volugisms எக். ஊ **20**

more able a more [0003] collinean electrophotographic apparatus, such 180] as a color printer or a color copier; ta color image is as of reproduced by utilization of cyan toner, magenta, toner, on its yellow toner, and black toner. Particularly, among color: (25) printers; some page printers-which forms a latent image and on a photosensitive drum by utilization of a laser beam ALCO! develop, the latent-image by: use of charged toner; and pare transfer an image formed from the thus developed tonerv and onto transfer paper can change an area to be exposed 6:30; by the laser, beam within as dotrin various manners is a to Thus, even when the number of dots persunit area is to be small, those page printers; can reproduce a color, imagens of with high resolution and high gradation; for bereab to selphs [0004] it is in such a color-electrophotographic appara elesso tus, addithering method has been widely sutilized as andorio binary-coding method to be used for iteproducing the neo halftone of a gray-scale image. According to the dither 9703 ing methodaby reference to conversion tables which are autor called dither matrices or threshold value matrices and a 40 which idefine: the acorrespondence between shalftoneds vol data and image production/data; a determination is assi made as to whether color spot is displayed in each dot visit or note: A dot is 20Nowhen color spot is displayed and 16 85 "OFF" when color spot is not displayed (Halftone spots 545) are produced by one dot or some adjacent dots turning/lape: "ON", and halftones of the imagestare reproduced on #106; the basis; of the sizes of halftone spots: void in the basis; of the sizes of halftone spots: void in the basis; [0005] Dots are arranged in the direction of primary: 000 scanning in which:a laser beam is moved for scanning 0.50 (hereinafter, referred to simply as a "primary-scanning size direction") and in the direction of secondary scanning in white which transfer paper is fed (hereinafter referred to sime a det ply as a "secondary-scanning direction"). As some dots no rebecome "ON" and thus form the "core of the growth" of: 55: halftone spots: As the gray-scale level of the halftone stab data is increased further; the number of "ON" adots is the eventually increased, thus gradually enlarging the size

of the halftone spots നാർപ്പും അട്ടേ ഒര് ന് മാന ഈ ഉന്നട

[0006] sa cFIG: 10 shows the combination of the angle of the combination of the combinati a cyan screen, the angle of a magenta screen, the angle of a yellow screen, and the angle of black screen, which has has conventionally been used in wide applications of industrial printing systems. As shown in the drawing, according to the conventional technique, the angles of four color screens are set; specifically, the angle of the yellow (Y) screen is set to 0°; the angle of the cyan (C) screen [or the angle of the magenta (M) screen] is set to 15°; the angle of the black (K) screen is set to 45°; and the angle of the magenta (M) screen [or the angle of the cyan (C) screen] is set to 75° [0007] It is also known that, if the screen angles of the halftone spots are shifted in order to prevent chromatic, imisregistration; a3/so-called imoiré fpattem (35), appears: It has empirically been acknowledged that a shift of angle of about 30° between two color screens is optimal for increasing the spatial frequency of the moiré: pattern; to thereby render the moiré pattern inconspicu- or conspicuous. Yellow is less noticeable to the human seye. Therefore, the other 3 color screens (C,M,K) are set shifted be ! from each other by 30% Further, the angle of the black screen; which isomost noticeable to the human eye; is 35% set to:45% so:aspbe most distant/from a longitudinal angle of 0% and a horizontal angle of 90%, which are eas-1990% ily recognized by the human eye. The angle of the cyan a " screen is set to 15% and the angle of the magenta screen is set to 75° s The angle of the yellow screen is a lar set to 0°. Although the yellow screen is set to the longitudinal direction or the horizontal direction that are most 100? noticeable to the human eye; the yellow screen does not were become greatly-noticeable because vellow is least med noticeable to the human eye, seve work the secretary series of the [0008] As mentioned above, the industrial printing system is designed so as to prevent a moiré pattern by setting the magentaror cyan screen to an angle of 15° or 200 75° and protating athercolor screens Since the color Si screens are only rotated, exactly as they are; the pitche -among-halftone spots is maintained uniform throughout 150 the 4 colors down in an investoring to hedman lent inview a con-[0009] In Initian electrophotographic apparatus utilizing a laser beam, the pattern of dots, which can be developed by an engine for developing an actual image on the basis of image reproduction data; is limited to the well direction of primary scanning in which a laser beam is actuated for scanning, as well as to the direction of secondary scanning in which paper is fed. Unlike the industrial printing system; the electrophotographic apparatus is incapable of rotating the color-screens to arbitrary as we angles: Accordingly, in the electrophotographic apparatus, desired screen angles are achieved by shifting the 1910. positions of the dither matrices to be used for the dithering method in primary or secondary scanning direction. or by changing the data in the conversion table, as 1978 required.

[0010] FIG. 2 is an illustration for describing a conventional method of determining screen angles in dith-

BNSDOCID: <EP

[0014]

ering method. In this example, dither matrices:40, leach :: >

vide an electrophotographic apparatus capable of

achieving screen angles related to an irrational langent.

An object of the present invention is to pro-

SUMMARY OF THE INVENTION

from a plurality of dots.

a method of processing an image produced by the electrophotographic apparatus, and a recording medium on which an image processing program is recorded with regard to a color electrophotographic apparatus which is reproduces an image by utilization of halftone spots formed from a plurality of dots in ಚಲನದ ಸರ್ಕಾರ ಕರ್ಣದ ಸಂಗರ್ಭ [0015] STO Another object of the present invention is to provide an electrophotographic apparatus capable of making uniform pitches of halitone spots in a screen *** compatible with a plurality of colors a method of the processing ran image aproduced by the electrophoto in the electrop graphic apparatus, and a recording medium on which an image processing program is recorded with regard to a color electrophotographic apparatus which reproduces an image by utilization of halftone spots formed. [0016] Still another object of the present invention is 1991 to achieve the objects through use of a reduced number 5 34

4

ī,

٠, ٢

Ź

では

13

32:

4

ij.

ŧ.

. .

madethoayC

of conversion tables: "short neyon to not trailled it it men. In these t [0017] 65 An image reproduction engine which causes the . toner to adhere to a development region of certain area. located at a certain position within dots according to a second of the s image reproduction data is utilized for image processing, wherein a halftone is expressed by means of halftone spots/formed/from/a plurality of dets.\The centroid and of a halftone spot formed from a single dot or a plurality of adjacent dots can be shifted from the center of the dot to ansarbitrary position thus achieving desired, screen decise angles or desired dot pitches: As a result, screen angles related to an irrational tangent can be realized, and the pitches of halffone spots of a plurality of colog screens can also be made uniformbe au est est boritern gribos, yranin [0018] attitue the case of an electrophotographic apparatiles ratus which radiates a laser-beam onto a region of dots " Pri while being scanned in a given direction; the present size invention enables the position and area where the laser to the beamsis radiated to the controllably changed to ran affile Star trary positions and ranea sforceache dot; by-producing a would laser drive pulse signal according to image reproduction of the data by means of pulse-width modulation (PWM) as The alle produced by one donor or sonle adiacent total tumberiuper [0019] partn order togreduserthe volume of conversion 300 tables which are provided within a controller of an elecsol 91 trophotographic apparatus on addriver of the thest and 2000] which defines the icorrespondence, between halftone costs data and image reproduction data; the present invention (\$15.7) utilizes an index-type conversion table. The conversion table comprises a plurality of ytables defining the correspondence between halftone data and image reproduc- 2000 tion data and a pattern matrix which includes reference 3.550 data representing ytables telberreferred to so as to corporate a responds tonal matrix includingsal planality of dots:: By (455)

means of such a configuration, some of reference data 20% a

measuring m x m, are shifted from one another so as to. correspond to image, data, thus achieving asscreen. angle θ; i.e. tan:θ = b/a. In a more specific example ::! shown in FIG. 2, dither matrices 40 are shifted such that 2.51 in a horizontal row of dither matrices 40 peach dither and matrix 40 by a given amount, such that after four shifts we the last dither in the row is vertically shifted by and a amount corresponding to the height of one dither matrix. 10 40. Therefore, we have tan θ = 1/4. A dither matrix 42 designated, by broken lines comprises an plurality of an dither matrices 40. It is possible to determine the screen as a angle at an arbitrary value with higher degree of free: dom by means of such a large dither matrix 42. 1 19:37 515 [0011] SLEA screen angle of a 15% for magenta and a JET. screen angle/of 25 v for cyan, which are deemed to conseque tributed to the best picture quality in the printing indus- if is try, are related to an irrational tangent (i.e. par tangent of ... which is an irrational number): Angles related to the irra-1120 tional tangent cannot be reproduced, so long as estim/ .a.o. ited number of dots/arranged in both the direction of enoprimary scanning and the direction of Secondary scan- and ning are utilized. For this season, in the conventional entre electrophotographicnapparatus; the magenta screent 125 and the cyan screen are set to angles which are related by as ity reenal tangent faan 8 maah meerah and "b" areer til integers), and @ = 150 and @ = 75% are not related to the excellent rational; tangent]; and close; to an ancile of 15° and an eros ast to 0°. Aithcuigh the vallow screen is set to the 75, ho eligns [0012] http://www.conceivable.roapproached toward night selecting anglesewhich; are related tootherrational tansource gent and close to \$5° and \$75° is to increase the size of poet the dither matrices 42. However, the number of dots persion unit area/which the engine can process is as small association e.g., 600r.dpis(dots/per jinch): df-the size/efidhe iditheretaya matrices is increased shalftone spot pitch increases and linea screen frequency is aliminished. Further an increase in the control of the contro the size of dither matrices also results in an increase i the number of corresponding required stables. Such an order increase in the number of y tables in turn involves an - sat increased in the wolume of apprecording medium follows recording the conversion tables. Eventually, the cost of as is the electrophotographic apparatuses increased: ha will be on [0013] in office case where halftone spots are formedd 45; by utilization of the dots fixedly arranged in both the direction of primary scanning of the laser beam fi.e., the subst primary-scanning direction) and the direction of secondary scanning of the same (he) the secondary-scanning; and direction); the pitch between haltone spots among they 50. color screens of different angles cannot be made uniform. Even in this respect of the electrophotographic and apparatus, encounters difficulty providing the same picture quality, as that provided by the industrial printing of the 11.80% **√ 55**) system: Jeide inclusive no end in Problem of 7. 35 FOLL SE MUSTRANCE DESCRIPTION OF F 36 C)

3

ខេត្ត ការប្រាស់ ដែលប្រាស់ មក ខែនេះ

sets in the pattern matrix can be identical, and a single

 γ table can be referred to by a plurality of dots within the $m_{\rm eff}$ pattern matrix. [0020] to To achieve the objects of the present invention, the present invention provides a color electropho-11.5% tographic apparatus; which; reproduces an image by the utilization of a plurality of color toners and by expressing halftone of each color through use of halftone spots formed from a plurality of dots, the apparatus comprises: ing: a halftone processing section which is provided with $\approx 40\,$ halftone-data for respective colors and which greproduces the image reproduction data corresponding to the comb dots on the basis of the halftone data by reference to a 3003 conversion table defining the correspondence between the the halftone data prepared so as to correspond to the ac 15 dots and image reproduction data; and an image reproving a duction engine which is provided with a drive signal cor-, 5 of responding to the image reproduction data and which are causes the toners to adhere to a development region and whose area and location correspond to the image reproduction data, within the dots, wherein the halftone 2 - 6 processing section prepares the image reproduction (100) data to be used for changing the angle of one-color-nips screen of the plurality of color screens to substantially an angle related to an irrational tangent and a real at 1025 [0021] A Further to achieve the objects the present to its invention, provides a color electrophotographic apparatus which reproduces an image by utilization of a plural. AD ity of color-toners and by expressing halftone of each this color through use of halftone spots formed from a plural-si-30. ity of dots, the apparatus comprising a halftone room processing section which is provided with halftone data high for respective-colors and which reproduces the image of entit reproduction data, corresponding to other dots together bas basis of the halftone data by reference to a conversion at 85 table defining the correspondence between the halftone 2001 data prepared sonas to correspond to the dots and took image reproduction data and an image reproductions ediengine which is provided with a drive signal correspond- abla ing to the image reproduction data and which causes 40. the toners to adhere to a development region whose wisc area and location correspond to the image reproduction and data, within the dots, whereing the halftone processing and section prepares the image reproduction data to bestoca used for making the distances among the centers of the # 951 halftone spots, of the plurality of colors substantially and ർഗംവഴ ഒദ്യോഗ് Therefore, no arrangee entreer or Fig. alaupa [0022] The present binvention salso provides as the recording medium which reserves an image processing are seen method for use with the foregoing electrophotographic." (50) apparatus#andwaciprogram gused: fore effecting:cimage(if io) processing enamed to can next lesso sinord thousand an arrivation [0023] Features and advantages of the inventions represent 600 dpio. Formation of the halftone spot will be to will be evident from the following detailed description of a 1941 the preferred embodiments described in conjunction (55) with the attached drawings; such murriable sector of the PRODICA

Entities of the control of the contr

BRIEF DESCRIPTION OF THE DRAWINGS.

griensgracens news in at the latters first bour [0024] A In the accompanying drawings: () 45 (6) (300 (5)) remains at the grant of the property of the control FIG.51 is an illustration showing the combination of the angle of a cyan screen; the angle of a magenta" screen; the angle of a yellow screen, and the angle of black screen, which has conventionally been used in wide applications of industrial printing sys-0.3817175 tems; such as a cryph of a constant FIG. 2 is an illustration for describing a conventional method of determining screen angles; FIG. 3 is an illustration showing an example of halftone spot according to the first embodiment of the present invention of the cause of 10 cm. All FIG. 4 is an illustration showing an example of a . . halftone spot which is formed on the basis of the basis foregoing principle and is grown according to the first embodiment; and a bereium and to which am the FIG. 5 is schematic representation showing a conversion table used in the first embodiment; and the ship FIG. 6:is an illustration showing an example of the pattern matrix according to the first embodiment; 1996. FIG::7: is: a :diagrammatic: representation: of : an : 4: example of the y table according to the first embodiment; is a confirmation until \$ limbors, the major of the major of FIG: 8 is an illustration showing index-type converses sion tables according to a second embodiment of the present inventions among a subject to the following as

e: FIG. 9 is an illustration showing an example of a en-

pattern@matrixnaccording to athe vsecond rembodi@x000

mentage holiger instrugaleved etit iedt til fledrende slid

FIG. 610: shows: annexample of: fialftone ispots that not

have been grown according to the second embodi-

ment; to specific entimost permot policon promor ever ent

FIG. 1:1cis a/schematic diagram/showing the config-

uration of an electrophotographic system; and. 176 05 DE

PIG: 12 is:a schematic diagram showing another

configuration: of the relectrophotographic system. # 151 thems, four the dome in the set the center of the interest DETAILED DESCRIPTION OF THE PREFERRED AND MADE EMBODIMENTS have 600 of 300 and simple representations.

ethoard areason, as designated by a snown in he Embodiments of the present invention will be [0025] described hereinbelow by reference to the accompanying drawings. However, the illustrated embodiments: shall not limit the technological scope of the invention. FIG. 3 shows an example of a halftone spot page [0026] according to the first embodiment of the present invention. In this example, a single halftone spot SP is produced by formation of a development region designated. 30 as a shaded area, swithin dots D1 to D6 produced at; 1943 described by reference to electrophotographic system, see in which a laser diode is activated on the basis of image [3]. reproduction data in accordance with a drive pulse modulated by a pulse-width modulation method, to thereby part mendial medicine nimewine divong mentosia gi to a conditinate a resultant laser beamar a interest a militar

such that toner adheres to a region encompassing

[0027]

The laser beam is radiated onto the dot D1

approximately the rightmost one-fourth of the idot (here-2003) inafter called "rightmost one-fourth region"). The diameter of the laser beam is equal to; e.g., the longitudinal length of the dot, and the laser beam is radiated; onto a: desired region while being scanned in the transverse. direction of FIG. 3. Accordingly, in the case of the dot D1, the drive pulse for driving the laser is imparted with a timing and a width corresponding to approximately the rightmost one-fourth-region. The development position can be controlled by controlling the timing, and the area of development can be controlled by controlling the pulse widthment and time test earlier to grating the time to a solid 100281 A dot D2 is adjacent to the dot D1) and the: 15 laser beam is radiated onto a region encompassing approximately the leftmost one-tenth of the dot D2. The development region of predetermined width is realized by connection of the irradiated region of the adjacent dot D1.:to: the irradiated region of the dot D2. The entirety of a dot D3 is exposed to the laser beam. The laser-beam is radiated onto a region encompassing approximately the leftmost two-thirds of an adjacent deta D4. As a result, a wide development region is formed by connection of the irradiated region of the dot 03 to the irradiated region of the dot D4. Similarly, the laser beam: is radiated onto a region encompassing approximately. the rightmost one-half of a dot D5, and the laser beamis radiated onto a region encompassing approximately: the leftmost:one-fourth;region of a dot D6는 ns 등 문 요즘 [0029] our Thechalftone ispot (SP) shownxint@FIG: 35isa characterized in that the development region formed: from the dots D1 and D2 is narrower than the development-region-formed from the dots D5 and D6 and that the development region formed from the adjacent dots: 35 D1 and D2, the development region formed from the adjacent dots D3 and D4pand; the development region. formed from the adjacent dots 05 and 06 are shifted leftward. As a result, the centroid of the halftone spot SP. formed from the dots D1 to D6 (i.e., the center of the halftone spot-SP) is placed in a position shifted slightly from the center of the dots D3 to D6 in an upward and 21 15 leftward direction, as designated by X shown in the Each tiding has of the present invention, vil.gniwarb [0030] softman engine for reproducing an image pro-11345. duced: by an electrophotographic apparatus in which a drum is electrified; by exposure to a laser; beam and is a tonersis adhered onto the thus-electrified drum, even if. [65] the laser beam is radiated onto the regions such as the those shown in FIG. 3, the halftone spot-SP to be finally 150 reproduced becomes impressounded than the shaded region/shown in FIG: 3; by means of the shape of the £ 15 laser beam or the adhering-characteristic of toner. The center of the halftone spot can be placed at an arbitrary . See position without regard to arrangement of dots, by set- 55 ting the positions and areas within dots to be exposed to the laser beam, as required as the most of the control as the [0031] As mentioned above, a development region Fig. 8

of arbitrary area can be produced at an arbitrary location within a dot, by means of controlling the timing and "" width of a pulse signal used for driving the laser. Utilization tion of such a development method and formation of a 200 halftone spot-through use of development regions of a second plurality of dots enables controllable changing of the time position of the halftone spot to an arbitrary position. without regard to the pitch and arrangement of dots. Thus, the present invention enables formation of a halftone "spotkathan, arbitrary (position and realization) of the screen angles relatedato antitrational tangent and arbi-2003 trary-pitch of the halftone spotsport on where the contract of [0032] FIG. 4 is an example of a halftone spot which is formed on the basis of the foregoing principle and is " grown according to the first embediment. FIG. 4 shows a plurality of halftone spots to be formed from dots $D_{1,1}^{**}$ to D_{12,12} of a matrix pattern having 12 rows and 12 columns: As will be described later, a conversion table defining the correspondence between halftone data of dots and image reproduction data assumes the form of t a 12x12 matrixer in mered & larub luri bridge in than in hoose [0033] Each halftone spot may be formed from fouradjacent dots; six adjacent dots; or from some other stan number of dots. In either case, the center of the halftone spot is set at a desired location without regard to the in the pitch or arrangement of dots. For example, when the horizontal direction with reference to the point of origin OR located at the lower left end is taken as the X axis and the vertical direction with reference to the same origin is taken as the Y-axis, the coordinates of a halftone spot SP4 lare set to (8.272:0), and the coordinates of a 100 halftone:spot/SP2 are set to (10:5, 10:7). In this case, 12:19 the halftone spot SP41/18 formed from four adjacent dots; 101 and the halftone spot SP2 is formed from nine adjacent? 18 18 data noise unital a at a conservation at a conversion atob [0034] of A screen angle defined by the two halftone shall spots 8P Pariel SP2 (I.e.) the angle of a line connecting 5190 the halltone spots) 48-4.84 with reference to the YES -axis. The screen angle is very close to an angle of 15% 20% an angle-related to an irrational tangent: The distance : [7] between the two halftone spots-SP4 and SP2 is 9.0 dofs 300 long. Since two halftone spots exist between the halftone spots SP1 and SP2, the pitch between the halftone and specific spots-shown in FIGh 4 (lie) the linear distance between 1000 the halftone spots) assumes a pitch of 3:0 dots fin the 1930 screen whose angle is 0°, realization of a pitch of 3:007885 dots is easy. Therefore, the example screen of FIG. 4 can be used as a rotated ecreen of 0° screen with the 2003 same halftone spot pitch (3:0 dots): doldw mulce a ghib subst [0035] TOP the same manner ds mentioned previous ously, the screen angles of 15% and 45% shown in FIG: 10% 10% can be realized. In this case, the pitch of halftone spots and can also be set to a value of 3.0 dots; in the same man-2.400 ner as in the previous example of FIGS4; more present addition [0036] *** FIG. 5 is schematic representation showing 3 *** a conversion table used in the first embodiment. The table conversion table is ordinarily stored in a halftone processing section provided within an internal controller

of an electrophotographic apparatus. Image data shown

in FIG. 5(A) comprise halftone data for respective colors and corresponding to dots. The halftone data may corre- ...! spond to a color space of RGB or to a color space of CMYK. CMYK toners are commonly used in a color 5 electrophotographic apparatus. In such a case, the second image data comprise halftone data corresponding to Y, M, C, and K, respectively. He constituted to the Con-[0037] A pattern matrix shown in FIG. 5(B) and y 100 tables shown in FIG. 5(C) are applied to such image to data. In the first embodiment the pattern matrix consists of 12 rows by 12 columns. The ytable are prepared appe for each element of the pattern matrix and identified by (2) reference number(iii) (i = 1.to 144)...The pattern matrix in or a FIG. 5(B): contains the reference numbers to them ens table. For instance, given that the reference number of 46 % the pattern matrix corresponding to a dot: Profilmage 28's data is 27,2 image reproduction data: corresponding to 361 the dot-Phare determined by reference storthe yetable who whose reference number 27. Specifically, image repro-1020 duction data (an output value) corresponding to halftone data of image data:(an input level) are read by reference to us to the y table corresponding to reference number 27:200 ent [0038] A grOn the basis of the image reproduction data natio determined by means of the conversion table of the 225 engine utilizing a laser beam is provided with a laser ball drive pulse signal/modulated by:the:pulse:width modulated by:the:pulse:width modulated lation/method, activates: a daserreliode/in/accordance 53000 with the drive bulse, and radiates a laser beam onto a lexic photosensitive drum. Consequently, a laser beam is also radiated onto only a region of desired area on the left of 300 right side: within: and other adheres to the vthus: 1/0.4 irradiated region: The image reproduction data output 5/18 from the y table comprise data pertaining to whether the 2013 region to be irradiated is on the left or right side of the ulas dot, asswell as roulse width adata corresponding to the acre area of the region to be irradiated.05 enigna en 88 noitoes [0039] 350 FIG::6 is an illustration showing an example 9 EV of the pattern matrix according to the first/embodiments is is As mentioned above, the patterns corresponds to a supplementations matrix having 12 rows and 12 columns #Artotal for a 44 705 reference numbers (4 to 144) are assigned to elements 236) of the matrix without involvement of an overlap of an involvement of an overlap, or and and the [0040] teb :FIG::70is/andiagrammatic representation of: 180 an example of the vitable according to the first embodi-1/45 ment.:In this table input levels of halftone data are 340 associated with outputs including image reproduction and data pertaining to whether the right or the left side of the dot is to be irradiated with a laser beam and data per- at altainingsto the extent to which the region is to be irradiated. (In the example shown in FIG) 7, the y table 19-30 assigned to reference number of converts flow-level of se input data into high-level output data and corresponds 1890 to a dot in the pattern matrix which grows when the could input level of the image data is comparatively low. The 7 55 table assigned to reference number "m" converts input? " as data into output data so as to be insproportion to the AA input data and corresponds to a dot in the pattern matrix of US

which grows when the input level of the image data is comparatively intermediate level. The patable assigned to reference number optionresponds to a dot which to does not grow when the input level of image data is low but grows when the input level of the image data has reached a comparatively high level.

[0041] se In:the first embodiment, y tables of 144 types see associated with the pattern matrix having 12 rows and 12 columns. Consequently, the y table shown in 12 FIG. 7 also comprises y curves of 144 types.

[0042] TO An enormous pattern matrix such as A. H. 1000x1000 theoretically enables to realize screens with angles related to the irrational tangent or screen sets: with equal halftone spot pitch among the screens of different angles. However, since a limitation is imposed on the resolution (dpi) of the engine, the electrophotographic apparatus such as a color page printer cannot utilize such a pattern matrix of enormous magnitude. Further, if an attempt is made to achieve a resolution of about *600 hdpi, itheli pitch / between shalftone / spots fill becomes too long (consequently, the screen frequency is reduced), so that the resolution of the resultant reproduced image is deteriorated drastically in the first in embodiment, the development region, which is located at a desired position within a dot and has a desired area, is controlled on the basis of the image reproduction data. As a result, even in the case of a small pattern matrix, the position of a halftone spot to grow is controllably set to an arbitrary position where the halftone spot is not limited by the dot pitch or the arrangement of dots, thus achieving screen angles related to the irrational tangent or a uniform pitch of halftone spots. a

exists a necessity for providing y tables of 144 types went in the case of the pattern matrix having 12 rows and 12 columns. Such a Targe number of y tables for the pattern matrix having 12 rows and 12 columns. Such a Targe number of y tables and 12 columns. Such a Targe number of y tables and 12 columns.

[0044] [003] In a second embodiment of the present invention, the total number of γ tables is diminished by collecting, into a single table, γ tables assigned the same output for an input level of the work of the level [0045] [0045] [0045] FIG. 8 shows index type conversion table.

according to the second embodiment. In contrast with the conversion table shown in FIG. 5, wherein individual γ tables are assigned to respective elements of the pattern matrix, an index of the γ table is assigned to respective elements of the pattern matrix. The γ table is sought by reference to an index table. Consequently, a single γ table can be shared among a plurality of elements of the pattern matrix, and the number of γ tables can be set to a small value independently of the pattern matrix.

[0046] As shown in FIG. 2; in a screen whose angle has a rational tangent (hereinafter called a "rational tangent screen"), dots appear, in the form of completely identical patterns, in positions spaced apart from one another by a given distance in the longitudinal direction and a given distance in the lateral direction. Accordingly, dots can be designated within a square matrix of finite

size without-involvement of errors. Further dots appear is a within the square matrix in the form of completely identical patterns. In this sense, the index-type conversion to table is advantageous in the case of the rational tangent some screens of a square level of the square patterns.

[0047] Strictly speaking halftone spots of the same and pattern do not appear in the irrational tangent screen. In-0.1 the second embodiment, 144 y tables are classified into according to the second embodiment, 144 y tables are classified into according to the second embodiment. a group of tables corresponding to halftone spots whose : - :right portions are development regions (i.e., regions exposed to a laser beam) and another group of matrices corresponding to halftone spots whose left portions are development regions. Of the plurality of thus classified in a γ-tables, w tables with similar input-output correspondence are collected of the thus-collected adjacent ptables of 15 are assigned a single index. ent to (lot) not university [0048] FIG. 9 is an illustration showing an example as a of a pattern matrix according to the segond embodiment. The pattern matrix shown in FIG: 9 represents in ... the form of a single pattern matrix; the pattern matrix of 20 shown, ia FIG: 8(B) and the index table shown in FIG. and the 8(C). In the pattern matrix shown in FIG. 6 in connection at a with the first embodiment adifferent by atables have such assigned to all the elements of the matrix having 12 355 rows and 12 columns. In contrast, in the example shown 5, 25 in FIG. 9. y tables of 36 types are assigned to 144 elements of the matrix having 12 rows and 12 columns: Numbers assigned to 144 elements shown in FIG. 9 Materials designate indices of the vitables. Accordingly, a tables dos are understood to be assigned to the elements in an anage overlapping manner. For example, the vetable assigned and number 1 is allocated to relements $Q_{1110}, Q_{1.6}, Q_{270, Q36}$ D_{3,10}, D_{7,12}, and D_{10,11} of the pattern matrix [0049] an Asimentioned above the total number of visite tables can be diminished by collecting y tables; assigned 15.35 to dots whose development regions are on the same bas side and which output substantially the same value in and response to an input. Specifically, the adjacent γ tables $\phi(z)$ of the atables shown in FIG: 7 are collected into a single is with Milesting, no a single racte, y lables assigned in guong FIG. 10 shows an example of halftone spots made that have been grown according to the second embodic according ment; Eyencin this example the development regions of the formed in respective dots differ in position and area from a second seco one dot to another. Consequently, the center coordinates nates of the grown halftone spot SR4 are (8.2, 2.0), and the center coordinates of the grown halftone spot SP2 are (10,5, 10,7). The halftone spots SP1 and SP2 can de be placed in the same positions as those shown in FIG. At this time, the screen angle θ assumes a value of , 50 about 15°, and the pitch of the halftone dot-assumes a value of 3.0, as in the case of the example shown in FIG. 4 state the terms of the cut in the good an interior set [0051] As is evident from comparison between the example shown in FIG. 4 and the example shown in -55 FIG. 10, the dots D_{1,10} D_{1,40} D_{2,70} D_{3,100} D_{7,120} and one D_{10,11} shown in FIG. 4 correspond to dots whose rightside portions, are developed or remain substantially undeveloped: In contrast, as a result of allocation of the # is single y table to the corresponding dots shown in FIG2** of 10, the right-side portions of all the dots are developed to the same area; a policy of Fig. 10 where the fix of the part of the same area; a policy of Fig. 10 where the fix of the part of the same area; a policy of the part of th

FIG. 11 is a schematic diagram showing the 11 configuration of an electrophotographic system! In this [2003] example rathost computer:50 produces image data (56: 41) comprising RGB halftone data (each data set including 1965) eight bits, and the halftone data: comprise a total of 24 : 11 bits). The RGB halftone data are delivered to an electrophotographic apparatus 60 such as a page printer On 💯 🤭 the basis of supplied image data 56, the electrophotographic apparatus:60 reproduces a color image. The color electrophotographic apparatus 60 comprises a controller 62 which processes an image and supplies laser drive data 69 to an rengine, and an rengine 70 which reproduces an image according to the drive data 69.150 % [0053] and By smeans, role and application program (52; 50.5) such as a aword processing program or argraphic tool, et al. the host computer 50 produces text data; graphic data; " of bit-map data or the like. The data sets produced by the area application program 52 are rasterized by means of a 1950 electrophotographic papparatus andrivers software 54 mass installed in the host computer 50.2The thus-rasterized 49.30 data sets are converted into the image data 56, each 1244 pixel ordet of which comprises respective RGB halftone disc physicians denn. Concequently, a laser beattest attack [0054] #6. The relectrophotographic gapparatus #60 Dis 2007/ provided with an aunillustrated; built-in: microprocessor, 1700 and the microprocessor sine combination. With a control in 1911 program installed therein constitutes a controller 62 mais including casicolori; conversion (section ::84) as halftone press processing section: 66, and alpulse-width modulation: 300 section 68. The engine 70 begut a laser driver 72 actions as a vates a Jaser diode 74 for drawing an image on the basis (COP) of the drive data 692 Although the engine 70 comprises 9.49 to alphotosensitive drumpartransfer belt, and a drive see-in AA tion, these elements are omitted from FIG. 181, privari sittam [0055] hamilineocoloroconversion section a643 provided a less within the controller 62 converts RGB halftone data 569 to to that are supplied for each dot-into/CMYK halfforie data() 40% 10 which are complementary to the RGB data. In the kerne CMYK halftone data 10 ceach colombalftone data set trom comprises 8 bits and a maximum of 256 gray scales costs: The color conversion section 64 converts the RGB half-carab tone data 56 for each dot into the halftone data 10 for at 100. each plane dot of the respective: GMYK colors. Consease the quently, the halftone processing section 66 is supplied and with the halftone data 19 corresponding to a plane dot of the last the respective colorate rish turner level-more rish this event and other resonance [0056] By reference to a previously-prepared conf. (). version, table defining the correspondence between the correspondence halftone data and image reproduction data; the halftone a data processing section 66 produces, from the halftone data to acc 10 for each dot, the image reproduction data 30 for each in the

7

U.

dot. The halftone processing section 66 produces the image reproduction data 30, which represent halftones; by utilization of; e.g., a multivalued dithering method. For example, through use of the conversion table comprising the pattern matrices and the matales shown in FIGS. 5 to 9, for each dot the halftone processing section 66 can produce the image reproduction data 30 which represent the right or left region, and the area of the region.

[0057] in a preferred embodiment, through use of the multivalued dithering method, a color printer of as low dot per inch as 600 dpi is possible to have a high resolution; by a high frequency screen with small spot pitch, and also halftone processing section:66 can set the center of a halftone spot at an arbitrary position regardless of the position of the dot. As a result cirrational tangent screens can be realized; and the pitch of halftone spots among screens of different colors having different angles can be made substantially equal to

[0058] FIG. 12: is a schematic diagram showing another configuration of the electrophotographic system. This configuration corresponds to a modification of the system configuration shown in FIG::14::in:the system shown in FIG. 12; a driver software 80 installed in the host computer 50 has a rasterization function 54. the color conversion function 64, and the halftone processing function:66. These functions:54:64pand:66 - 31 are analogous to the functions of the elements assigned: the same reference numerals shown in FIG. 11.6 The image reproduction data 30 produced for leach color by means of the halftone processing function 64 are supplied to the pulse-width modulation section 68 of the controller, 62 provided within the selectrophotographic apparatus: 60, such as:a page printer, where the data are converted into the desired drive data 69 and delivered to the engine 30t no beaubarger era stob add [0059] distributed examples of the system bonfiguration shown in FIG. 12, the driver software 80 installed in the host computer 50 performs color conversion and half-

tone processing operations: thruthecepample shown in FIG. 1.11 the controller provided within the electrophotographic system performs color conversion and halftone processing operations. In the example shows in FIG. 12, the host computer 50 performs conversion and halftone processing operations infridemand exists for the electrophotographic apparatus 60 to be inexpensive, the price of the apparatus is required to be diminished by reducing the capability of the controller 62. In such a case, ant effective measure is to implement the color conversion processing and the halftone processing, which are portions of the functions offered by the controller shown in FIG. 11, by means of the driver program installed in the host computer. In a case where the driver 80 performs halftone processing the storage medium having recorded thereon a program for causing 55 the computer to perform the foregoing halftone process-

ing procedures is incorporated into the host computer"

50. ಈ ತಿ. ನಡೆದು ಇತ್ತಿಗೆ ಅಂತಿ ಕೆ ಸಾಗ್ಯ ಗಾಗಿ ಎಂದ ಸಂಘಾಕಗಡಿತಿತ

[0060] The Astronomic above, the present invention enables the relectrophotographic device capable of reproducing only astimited dot density to materialize screen angles substantially related to an irrational tangent with a small pitch of halftone spots and high resolution. Further, the all pitches of halftone spots of different color-screens having different angles can be made substantially equal at a limited dot density.

rounde atteak kinn entaltearn into die inschilie in 2000 km/s (1960 km). Claims ung authoritination für hohat sin chilin 1970 km/s (1990 km) generatif in mit integration in 1980 km/s (1990 km).

- 1. A color electrophotographic apparatus which reproduces an image by utilization of a plurality of color toners and by expressing halftone of each color through use of halftone spots formed from a plurality of closs said apparatus comprising: 200 100 and a new note so that a second and the colors and a second accession of the colors.
 - a halftone processing section which is provided with halftone data for respective colors and cubic reproduces image reproduction data by reference to a conversion table defining a correspondence between the halftone data and comage reproduction data; and
 - an image reproduction engine which is provided with a drive signal corresponding to the strange reproduction data to thereby cause the sectioners to adhere to a development region whose area and location correspond to the mage reproduction data, within the dots,
 - wherein said halftone processing section prepares the image reproduction data to be used of some changing an angle of at least one color enscreen of a plurality of color screens to substantially an angle related to an irrational tancogent ent of enember of menor entire succession.
- 2. A color electrophotographic apparatus according to claim 1; whiefein said image reproduction engine radiates a speam to the development region to thereby sauses the toners to adhere to the development region, and
 - chite image reproduction data comprise data pertaining to a position and an area to be exposed within the dot in a scanning direction of the beam. It has reliable to yille uso a scanning constitution as a scanning direction of the beam.
- A color electrophotographic apparatus according to claim?, whierein the conversion table comprises agrees and additional words at a page attention.
 - a plurality of y tables each defining the correspondence between the halftone data and the image reproduction data; and
 - a pattern matrix having reference data, which reference data show the y table to be referred to in response to the matrix having the plurality of dots.

医新生物 医电池性外膜炎 製品

15

- 4. A color electrophotographic apparatus according to a selaim 3 physical partial overlap exists in the refersion elaim 3 physical provided within the pattern matrix, and a serion eight γ table is referred to by the plurality of dots within the pattern matrix (3 physical physic
- 5. A color electrophotographic apparatus which repro-electrophotographic apparatus which repro-electrophotographic apparatus which repro-electrophotographic apparatus which repro-electrophotographic apparatus of a plural to ity of dots, said apparatus comprising:
 - THE OF NOUTDERN BE 15. 35.40 4 a halftone processing section which is provided with, halftone, data toft respective, colors and which reproduces the image reproduction data corresponding to the dots on the basis of the halftone data by reference to a conversion table the indefining as correspondence between the shalfbris tone data and image reproduction data; and to han image reproduction engine which is prowided with a drive signal corresponding to the image reproduction data to thereby cause the toners to adhere to a development region .o. whose area and location correspond to the see image reproduction data, within the dots inv wherein said halftone processing section preparesthe image reproduction data to be used for making distances among centroids of the halftone spots of the plurality of colors substanwherein said hardone processialsupe yllsiture.
- 6. A color electrophotographic apparatus according to claim 5, wherein said image reproduction engine radiates care beam to the development in the development region, and
- 7. A color electrophotographic apparatus according to claim 5, wherein the conversion table comprises
 - a plurality of γ tables each defining the correspondence between the halftone data and the image reproduction data; and inquire to a pattern matrix having reference data, which reference data show the γ table to be referred to in response to the matrix having the plurality and of dots to restrict on near sectional.
- 8. A color electrophotographic apparatus according to claim 7, wherein a partial everlap exists in the reference data provided within the pattern matrix, and a single γ table is referred to by the plurality of idots within the pattern matrix.

- 9. Admethodrof processing antimage of color electro-photography by utilization of a plurality of color-fon-ers and by expressing halftone of feach color through use of halftone spots formed from a plurality of dots, said method comprising: 1 dots of grade color of color of
 - a halftone processing process, in which halftone data are provided for respective colors
 and the image reproduction data corresponding
 sing to the dots are produced on the basis of the
 halftone data by reference to a conversion table
 of defining the correspondence between the halfcuttone data and image reproduction data; and
 the and image reproduction process; in which a
 not drive signal corresponding to the image reproenduction data is provided and the toners are
 concerned to adhere to addevelopment region
 provehose carea and location correspond to the
 image reproduction data; within the dots; in the
 - image reproduction data; within the dots; is the the time griswherein; in the halftone processing process; is a seventhere are produced the image production for a characteristic be used for changing an arigin of at the expleast one color, screen of a plurality of colors of its screens to substantially an angle related to an interesting a serior of a processor of employers and tangents as a serior of a processor of employers of the employers and the employers of the employers of the employers of the employers.

43

ă.

.

Ź.

ō.

T.

74. L

五 泛

- 10. A method of processing an image of color electrophotography by utilization of a plurality of color tonersTand by expressing shalftone of reach colors sat through:use:of halftone spots formed from a plural proitypof dots, said method comprising pothad entitle an sem piled to the pulse-width modulation section 68 of the bilder halftone processing process, line which half- is the statone data of respective colors are provided and applications. and corresponding to a religious filtration data corresponding to the dots are reproduced on the basis offthe base no halftone data by reference to a conversion table (300) enidefining the correspondence between the half- one Historie data and image reproduction data; and the same ni ancimage reproduction process; in which a end -ondrive signal corresponding to the image reproeraductionadataais/provided/and/atheatoners/cate/9/19 @icaused.to: adhere ato- a developmento regional con -Mawhose sareay and alocation (correspond) to the discrete adjimage/reproduction/data/within the dots/scoop sold eviwherein; in the halftone processing process; male barthere sared prepared athe simages reproduction of the த rdata to:be:⊌sed for making distances among காறி centroids of the halftone spots of the plurality of \$65.3 pricelors substantially equality grassionia in a meson of that are detends of the functions offered by the con-
- 11. A-recording medium having recorded thereon an agent image processing program used for causing a competitive puter to perform color electrophotographic image sold processing procedures for reproducing animage by a utilization of applurality of colorationers and by the expressing halftone of each coloration use of a sold halftone spots formed from a plurality of dots, said

9

50

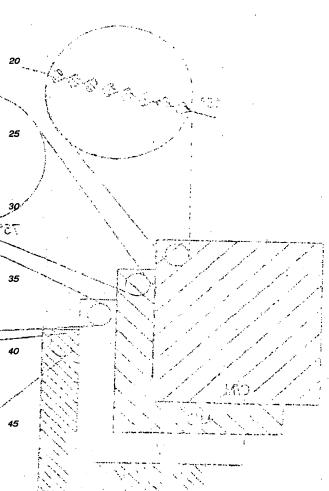
BNSDOCID: <EP___1026878A2_1 >

image processing procedures comprising:

a halftone processing procedure, in which halftone data are provided for respective colors and the image reproduction data correspond- 5 ing to the dots are produced on the basis of the halftone data by reference to a conversion table defining the correspondence between the halftone data and image reproduction data, wherein the image reproduction data comprise data pertaining to a position and area to be exposed within the dot in the scanning direction of the beam, and the halftone processing procedures produces the image reproduction data to be used for changing an angle of at least one its color screen of a plurality of color screens to substantially an angle related to an irrational tangent.

12. A recording medium having recorded thereon an image processing program used for causing a computer to perform color electrophotographic image processing procedures for reproducing an image by utilization of a plurality of color toners and by expressing halftone of each color through use of halftone spots formed from a plurality of dots said image processing procedures comprising:

halftone processing procedures, in which halftone data of respective colors are provided and the image reproduction data corresponding to the dots are reproduced on the basis of the halftone data by reference to a conversion table defining the correspondence between the halftone data and image reproduction data, wherein the image reproduction data comprise data pertaining to a position and area to be exposed within the dot in a scanning direction of the beam, and the halftone processing procedures produces the image reproduction data to be used for making distances among the centroids of the halftone spots of the plurality of colors substantially equal.



n monum. Liberales sum grasumbong sigstri

a half in a provision on ourse, in the militar's did to least seed settle musically a did to least settle musically of mays included to dending which means to broadcored in the cules of bed defined the code carbon seed of the code of the code of the certification of the code of the certification of the certification of the certification of the code of the code of the certification of the certification of the code of the certification of the

FIG. 1°

ANGLES OF CMYK SCREENS are a give the programmed to be the ob-

inegnat til å riklarding delikum riyern recorded mereon en -modigigf, auco (o) beau risi goto gnis apuda and r puter to use and compropropositional yo ayay ne golodholgar lof kaf keakhol grikaashovo utilization or a plurality of color foners (and by expressing hallmone of each colds through the of halfigine sucts for neu trom k of rollly or portugald image brocesting urbustonies ontolerna: antitione processing procedure tene data ocrespaso the image repetitioned data co reproduced on the h ine dote an halitone do(a to reference to a convalsion tab men engi wherein in timage reproduction date comprise Sata pertair ing to a notition and area to be าเกมู่ direction exposed within the continua seasons cadures produces as ent process appears inc 20 29 GRBG a**ZX** le solotines snote of the plurality of เวียม ลาดเออ

FIG. 2

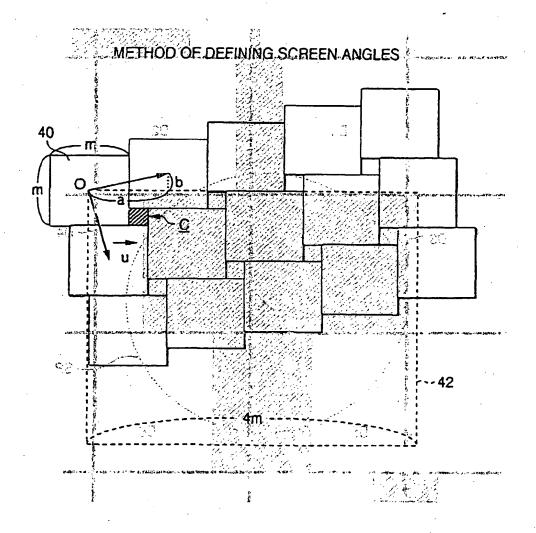
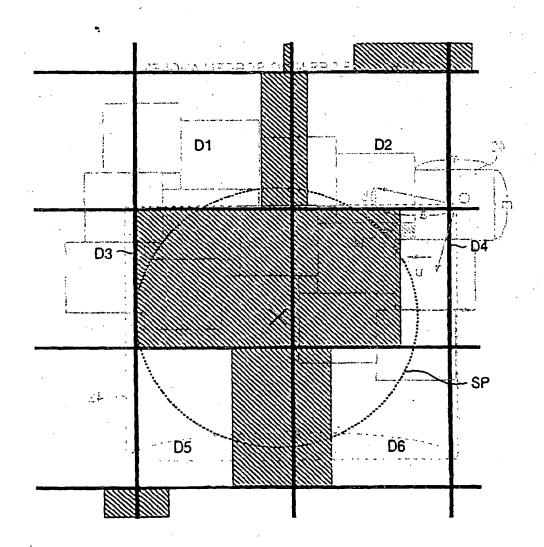
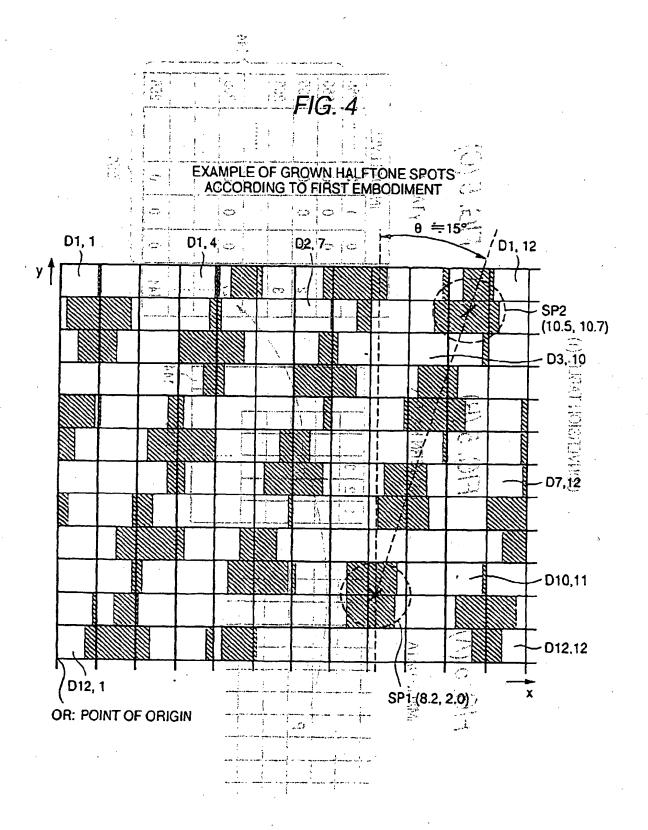


FIG. 3

EXAMPLE OF HALFTONE SPOT ACCORDING TO THE INVENTION





EP-1/026 878 A2

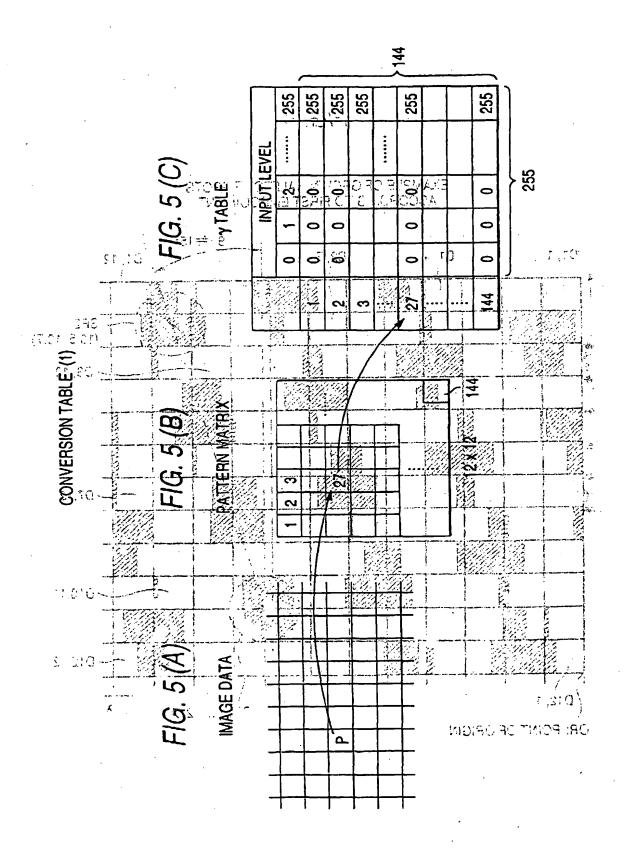


FIG. 6

1	2	3	4	5	6	7	8	9	10	11	12	
13	14	15	16	17	18	19	20	21	22	23	24	
25	26	27	28	29	30 ∃J8Æ	31	32	33	34	35	36	
37	38	-39	40	41	42	43~	44	45	46	47	48	
49	50	51	52 ∠	53	54	55	56	57	58	59	60	
61	62	63	64	65	66	67	68	69	70	71	72	
73	74	75	76	77	78	79	80	81	82	83	84	
85	86	87	88	89	90	91	92	93	94	95	96	
97	98	99	-100	101	102	103	104	` 10 5	106	107	108	(C)
109	110	171	112	113	114	115.	116	117	118	119	120	
्र <mark>ो21</mark>	122	123	124	125	126	127	128	129	130	131	் 132	
133	134	135	136	137	138	139	140	141	142	143	144	

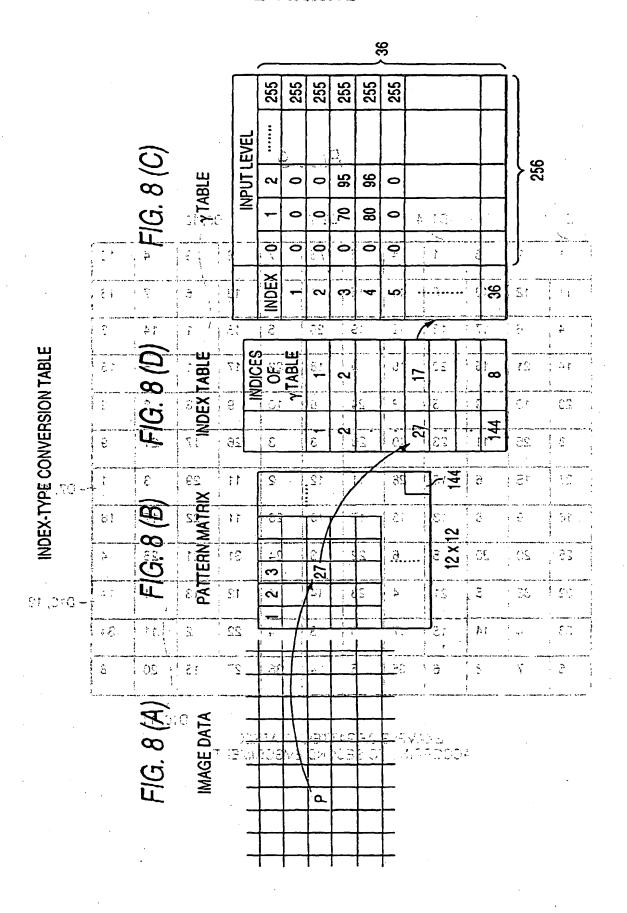
EXAMPLE OF PATTERN MATRIX ACCORDING TO FIRST EMBODIMENT

5-17

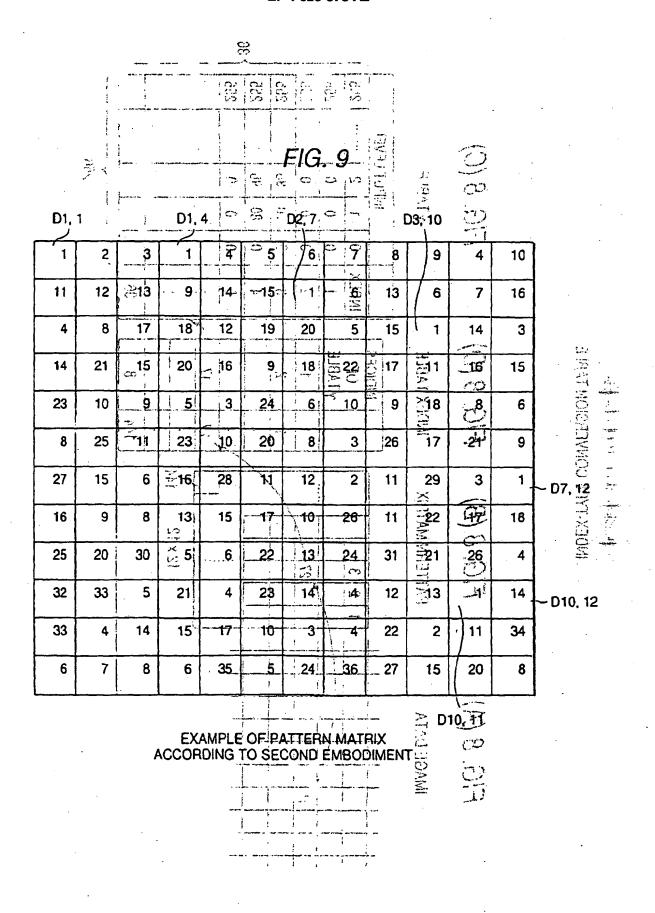
										المناجع مراجعتان راوي				J: #4m# 14	
144		i		101		Ç	! E	FIG.	7	; č:			1:	:	
de (meneral) a	45	*: - 45 - 4	2	22		12.	;	6:	19	1.25	a:	; 3; !		87	 !
	85.	i ĉ	ε.Ε	: 25E			: 56 :		1 00 TABLE	2.5	33.	1	. 23	135	1
	255 _[<u> </u>	<u>۔۔۔۔</u>	\pm	· · · ·				13-	1 1 =	+ 34	180	in the second	Ĥ	-
		j.	\forall			/						ļ			
(0)	- 58	1						ää	54	£3 ;	m 22				
2	23			6	1	68/	ist	1.50	68	66	المراز المراز	63	132		-
	3-0				/	73	jσε	ET.	E	177	7.5	75	\$ T	1	
			1	1		£6	92	J.E	90	98	35	87	88/	[8	
TO VIA	807		1	/20		<u> </u>	a01	103	sot	to:	QUE:	36	Ji z	158	, ,
	325			(5)	T	117	811	115	28.	Str	311	1		, ig	-
Elevanor de la	ુકા 0 0 -1	, I	£.1) () (`. f	671	52	, rg:	126	125	1451	123	337	25	5
,	_1:	٠ ـــ		Çı	A .	fà.	774	i (C)	INPI	Jf-LE∀	EL (HA	LFTON	IE DAT	A) SCI	1
		1		İ	ı			;	į.	*	1	i	y	t t	,

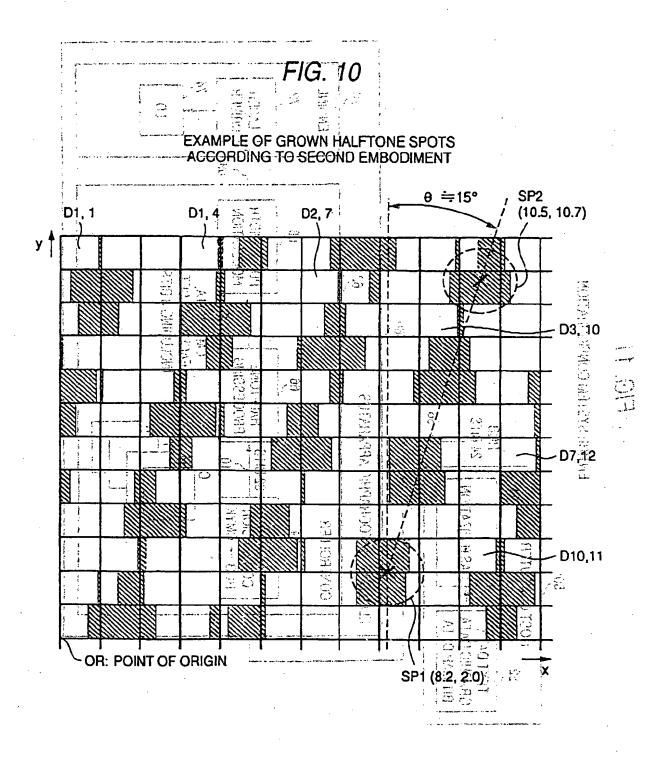
TENATURA TO TRADESTIVAXE TENATURA TO TRADESTA

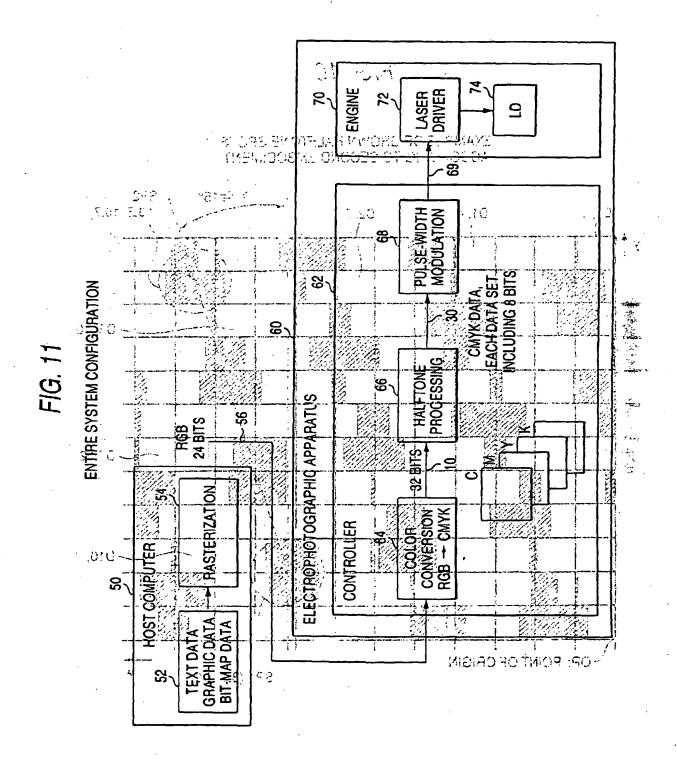
EP 1 026 878 A2



EP 1026 878 A2







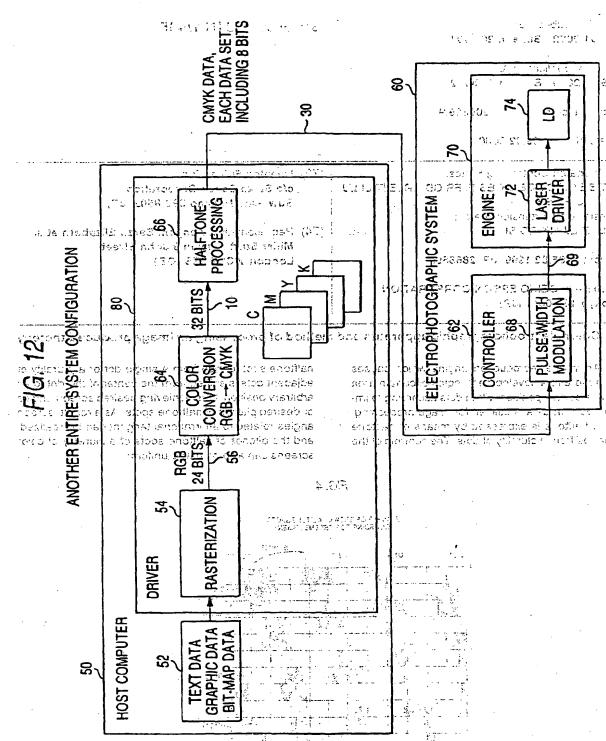
53710 noru5 na

iss rus Patinianti

proverdigue and or s

NOOPERA TATEAT SATIS

CA E . 8 821 1



22



Europäisches Patentamt

EA FIS RED 1 RE

European Patent Office

Office européen des brevets



1) EP 1 026 878 A3

(12)

EUROPEAN PATENT APPLICATION

(84) Designated Contracting States:

AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU

MC NL PT-SE

Designated Extension States:

AL LT LV MK-RO SI

(30) Priority 05 02.1999 JP 2866699

(71) Applicant: SEIKO EPSON CORPORATION

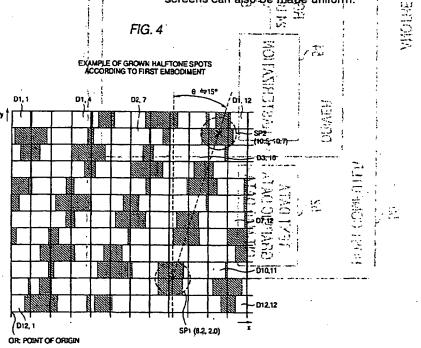
Tokyo 160-0811 (JP)

(54) Color electrophotographic apparatus and method of processing an image produced thereby

(57) An image reproduction engine which causes toner to adhere to a development region of certain area located at a certain position within dots according to image reproduction data is utilized for image processing, wherein a halftone is expressed by means of halftone spots formed from a plurality of dots. The centroid of the

halftone spot formed from a single dot or a plurality of adjacent dots is shifted from the center of the dot to an arbitrary position, thus achieving desired screen angles or desired pitches of halftone spots. As a result, screen angles related to an irrational tangent can be realized, and the pitches of halftone spots of a plurality of color screens can also be made uniform.

-



EP 1:026 878 A3

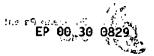


EUROPEAN;SEARCH REPORT: MAZING CAR BE 00 30 0829

Category	Citation of document of relevan	with indication, where appr t passages	opriate,	Relevant to claim	CLASSIFICA APPLICATIO	TION OF THE N (lint.Cl.7)
Y	EP 0 843 232 A 20 May 1998 (19 * the whole doc	(SEIKO -EPSON -COR 98-05-20) ::5 ument ***	PORATION)	1-12	H94N1/46	
Y .	EP 0 499 738 A 26 August 1992 * page 2. line	(ADOBE SYSTEMS I (1992-08-26) 27 - line 54 * 26 - page 7, lin	NC ₄) 6∃ e_35*	1-12	5,	S1
Y	EP 0 634 862 A 18 January 1995 * page 7, line	(AGFA-GEVAERT) (1995-01-18) 38 - page 10, li	ne 50 *	4,8	i	
4 ·	DE 197 22 697 A DRUCKMASCHINEN	AG)	90 20 			nama are e e e e e e e e e e e e e e e e e
A	3 December 1998 EP 0 430 860 A 5 June 1991 (19	(TOYO INK MEG. C	T to	ed Hubber f	<u>.</u>	206400
\	US 5 327 167 A 5 July 1994 (19	(B. T. POLLARD E 94-07-05) 5632	O'w		TECHNICAI SEARCHED	FIELDS (Int.Cl.7)
	204 - 34-84 ER 0 689 195 A 2 November 1995 3001 - 31-45 5001 - 30-20 8001 - 30-20 8001 - 30-75	(1995 <u>-11-02</u>) 7-7-5-28	ବ୍ୟ ବ୍ୟକ୍ତ ବ୍ୟକ୍ତ ବ୍ୟକ୍ତ		H04N	
	03-12-1098 63-12-1998 31-05-2666 65-21-2660	19732697 A1 9834889 A2 19839703 U2 8990243 A2 2019613135 TH	20 78 04 30 92	\$ - SI - ES	Å	16753741 B
;	25-12-15-1 12-57-1691 05-26-1593 08-26-1593 02-11-1693	2237857 A 2102177 A 3434.30 A 3711287 A 5050648 A	90 17 30 30 41	E - 38-63	<i>A</i>	662034
	The prasent search repo	rt has been drawn up for all	claims =		:	Razzia
	Place of search	1	pletion of the search		Examiner	
	THE HAGUE	Nov	ember 2001	De	Roeck, A	690005
X : parti Y : parti	ATEGORY OF CITED DOCUM icularly relevant if taken alone icularly relevant if combined w iment of the same category	MENTS A 5181851 4 875, 391	T: theory or princi E: earlier patent d after the filing d D: document cited L: document cited	ocument, but pub ate I in the application	lished on, ar	

EP 1 026 878 A3

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN FATENT APPLICATION NO.3.3



05-	1	1_	2	A	n	1
	_	_	~	•	v	4

Patent document cited in search report	Publication date	Patent family 1 300 1 201 Rublication member(s) 65 tubor forty date
EP 843232 A	20-05-1998	JP 3156605 B2 16-04-2001 JP 10150567 A 02-06-1998 EP 0843232 A2 20-05-1998 US 6052203 A 16-04-2000
EP 499738 A	26-08-1992 5.	DE 69123832 D1 06-02-1997 DE 69123832 T2 A 5 24-07-1997 EP 6499738 A2 1 20 1 26508-1992 EP 6030250 A 04-02-1994 US 5305118 A 30 1 30 1 30 1 30 1 30 1 30 1 30 1 30
EP 634862 A	18-01-1995	BE 1007264 A4-1 560 02-05-1995 AT 171330 T 15-10-1998 DE 69406929 D10T A 0502-01-1998 DE 69406929 T2-1061 18-06-1998 DE 69413330 D1 22-10-1998
700-96-24 PRIJSS 70-24 PRISS (PRIJS) 70-45,		W0 9502938 A1 26(1) 26-01-1995 EP 0634862 A1 18-01-1995 EP 0709012 A12A 61-05-1996 JP 7057104 A 03-03-1995 JP 8512444 T 24-12-1996 US 5654808 A 05-08-1997 US 5828815 A 27-10-1998
DE 19722697 A	03-12-1998	DE 19722697 A1 03-12-1998 WO 9854889 A2 03-12-1998 DE 19880703 D2 31-05-2000 EP 0990343 A2 05-04-2000 JP 2000513185 T 03-10-2000
EP 430860 A	05-06-1991	JP 3239567 A 25-10-1991 JP 3162177 A 12-07-1991 EP 0430860 A2 05-06-1991 EP 0711067 A2 08-05-1996 US 5259042 A 02-11-1993
US 5327167 A		EP
EP 680195 / A/5	702-11-1995/75	EP-109-00680195 A1 02-11-1995 A2 7299933 A 75-00-14-11-1995 A2 US 5901275 A 76-00-00-00-00-00-00-00-00-00-00-00-00-00

For more details about this annex-: see Official Journal of the European Palent Office, No. 12/82

FORM Pox59

acitio metr

Improprieta Per 323

ENEVEYOR ESS FROM

SATURITY OF

"好"大"我这一说母说从B的OPE

32 .

SENCTION OF NEW .

(Princesoff + 1 / West morning) (

This Page Blank (uspto)

ensuremetel

्रकामकार्याः । वाद्यासम्बद्धाः

entre de lemente

Bassami-Sannana-Strassa 7

the of gM named from the no ML one a diamentation of a solution

Calendary of Errona Nity Co. 2000

81.14" Minuarin (UE)

common (*) 179. Just -

20 Carpona Career Mail Car, Little (SIN action in explanation from the s

कार्या कराया स्थापन स्थापन हिन्दु का स्थापन स्थ

He is are relication wood must record to a unitary parect nonleadouser is a du late of habitona dos areas. Au - sakud nejske em grå det de 20 werdfarie is ledti yd nafficedd eldat gwyfod naftdamod air i'm Lefaludai' Wieneb While he mand or vedic of Labell, it wend to raise True of values read out nom on SPM (sursen cauch cheming to may be concored instead. Anem House to do on Service are recoverag, enclosive transfer for grace that should velves corresponding to Charletes of 1498 Etemporary has bount french for according to the officet According halfs me deficilling ा सारामार्थी रहा राष्ट्राचीए राष्ट्राध्या ३६ ३ ठ-३६१ स्टाइ स्कूबर २ i susmicipatri indi-fluori yiliri